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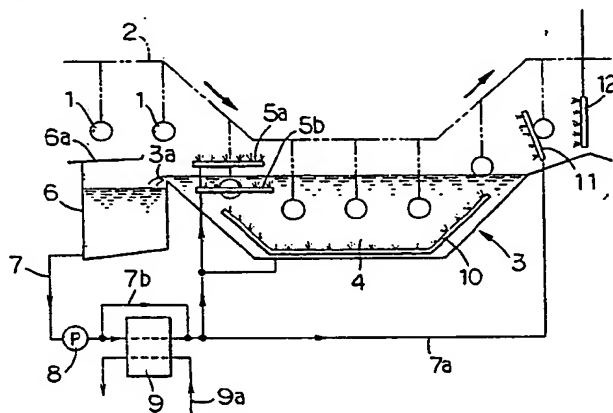
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(54) Method of treating the surface of an object and apparatus therefor.

(57) A method of and an apparatus for applying surface treatment on an object-to-be-treated which is continuously moved in a treating liquid from one end of a treating vessel toward the other end thereof usually by a hanging conveyer. The apparatus comprises an overflow outlet (3a) for the liquid disposed on the incoming end of the treating vessel (3), a overflow tank (6) for reservoiring the overflowed liquid, a return passage (7) for returning the liquid from the overflow tank (6) back to the treating vessel (3), a single or a pair of gush-spraying pipes (5a, 5b) of the treating liquid disposed on the incoming end over the surface of and/or immersed in the liquid, and at least one gush-spraying pipe (11), disposed on the outgoing end of the treating vessel (3).



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METHOD OF TREATING THE SURFACE OF AN OBJECT
AND APPARATUS THEREFOR

5 This invention relates to a method of surface treatment effectively applicable for treating or finishing the surface of metal articles or objects when chemical coating, plating, etching, etc., are carried out, and an apparatus suitably employable for that purpose.

10 Various methods have conventionally been known for treating or finishing the surface of metal articles, such as chemical coating, plating, etching, etc. Above all chemical conversion treatment for forming some kind of corrosion resistant film on the surface of steel plates or steel bars by means of chemical reaction or electro-chemical reaction is known, and more particularly phosphating, wherein zinc phosphate, manganese phosphate, ferrous phosphate, etc., are employed, is widely known. And it is widely practiced
15 as a method of surface preparation when steel members are coated in the field of, for example, car assembling, bridge building, or manufacturing of household electrical appliances.

20 When practising such a surface treatment objects-to-be-treated must be in general contacted with the treating liquid, and either of two ways, a spraying method in which the liquid is sprayed over the surface of the objects-to-be-treated and a dipping method in which the objects are dipped in the liquid is selected for contacting the objects with the liquid. The former spraying method is unsuitable
25 for treating objects of complicated shapes, for example car bodies which have portions difficult to be uniformly treated by spraying such as a fender, a door, or a constructed part into a box-like shape. The liquid is liable not to sufficiently reach the inside surfaces of complicated corners, leaving sometimes untreated portions or sometimes unsatisfactorily treated portions. The latter dipping method is
30 much better than the former in respect of the liquid reaching to many quarters of the objects-to-be-treated, but it

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still leaves something to be desired because some insufficiently treated portions or ununiformly treated portions are inevitably produced even in this method. Time difference which takes place in the course of dipping objects or articles into the liquid in respect of contact between the objects and the liquid may cause the traces of unevenness or lack of uniformity in the laying of the liquid on the surface of the objects. Sometimes it may leave a stepped portion of the treatment on the surface of the object according to the conditions thereof which disturbs the uniform contacting, for example, existence of moisture, oil stain, or air bubbles left there by chance.

This invention was made, against such a background, for eliminating the conventional disadvantages. It is therefore a primary object of this invention to provide an effective method of applying surface treatment uniformly on the articles and an apparatus preferably employable for the purpose.

This invention is, for attaining the above-mentioned object, featured in that an object-to-be-treated (hereinafter simply called article or sometimes object) is, when treated on the surface thereof by being dipped in a treating liquid while moved in one direction, sprayed with the treating liquid immediate before and/or immediate after the dipping into the liquid, the treating liquid is imparted a counter flowing against the moving direction of the object in the liquid, and the object is again given the gush-spraying of the liquid immediately after it has been lifted out of the liquid.

Preferred embodiments of this invention will be described with reference to appended drawing in which:

Fig. 1 is a schematic diagram showing the flow of a method of surface treatment when an apparatus of this invention is employed; and

Fig. 2 is a fragmentary sectional view showing the entered portion of the article in a treating vessel.

Referring to Fig. 1, firstly, this embodiment relates

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to zinc phosphate treating as a preliminary treatment on an object-to-be-treated such as a car body when it is applied with coating. As a first step for applying the zinc phosphate treatment the object is degreased with a trichloroethylene or alkaline solution, followed by water cleansing and contact with titanium phosphate solution as a second step. In this way nuclei for phosphate coating crystals are formed on the surface of the object. An object 1 which has been applied with such surface preparation is conveyed, being suspended from a hanging conveyer 2 as shown in Fig. 1, from left to right for being dipped into treating liquid 4 at the left part of a dipping bath 3. At the moment of dipping into the dipping bath 3 (it may be called a treating vessel) the object 1 is subject to gush-spraying of the treating liquid 4 from either one or both of a pair of gush-spraying pipes 5a, 5b (hereinafter called spraying pipe) with a suitable number of openings for spraying the liquid, the former (5a) being disposed over the surface of the liquid 4 at a position within 30 seconds before the dipping of the object 1 and the latter (5b) being immersed in the liquid 4 at a position within 60 seconds more preferably within 30 seconds after the dipping thereof. It is preferable that the gush-spraying of the liquid 4 from the spraying pipes 5a, 5b never fails to be carried out at least from either one side. Without this spraying of the liquid from at least one side, a stepped layer is liable to take place because of an uneven contact of the liquid with the object 1 on the surface thereof. Another disagreeable phenomenon observed at this time is a possible formation of ferrous phosphate coating on the object 1 due to contact thereof with the mist or vapor of the liquid 4 in the air atmosphere before being dipped into the liquid 4. Spraying of the liquid from the spraying pipe 5a over the surface is particularly effective and desirable when the object 1 is unfitted to wetting. And position setting of the

spraying pipe 5a within 30 seconds before dipping of the object 1 comes from an experimental data wherein if the object 1 sprayed with the liquid 4 is stayed in the air more than 30 seconds the crystal zinc phosphate becomes
5 mixed crystal of bulky hopeite and phosphophyllite of low corrosion resistance. If the time duration is less than 30 seconds the crystal zinc phosphate comprises chiefly fine phosphophyllite and shows about 1.5 times as high corrosion resistance as the former.

10 The object 1 is transported in the dipping bath 3 from the initial step where it is dipped first toward the final stage where it is taken out of the liquid 4, covering the distance in 60 to 300 seconds, so as to be completely covered by the crystal zinc phosphate on the whole surface
15 thereof in the meantime. At the left end, in Fig. 1, of the dipping bath 3, i.e., on the initial dipping side thereof an overflow outlet 3a is formed for allowing the overflow of the liquid 4 therefrom, and the overflowed liquid 4 is recovered by a recovering tank 6 or an overflow tank, which
20 is provided with a shelter plate 6a on the upper part thereof for preventing the mist or vapor of the liquid 4 from injuring the passing objects 1 thereover. The liquid 4 recovered in the recovering tank 6 is returned, by virtue of a pump 8, by way of a return passage 7 or a conduit and
25 either via a heat exchanger 9 having a proper heating medium, flowing passage 9a for heating the returning liquid 4 up to a predetermined temperature or via a by-pass passage 7b by-passing the heat exchanger 9, to the spraying pipes 5a, 5b and another spraying pipe 10 disposed on the bottom of the
30 dipping bath 3. This series of the returning flow of the liquid 4 is greatly helpful in imparting a counterflow to the liquid 4 in the dipping bath 3 against the travelling direction of the conveyed objects 1 therein, which consequently contributes to giving uniform contact of the liquid
35 with the conveyed objects 1.

On the right side, in Fig. 1, of the dipping bath 3, i.e., downstream of the travelling object another spraying

pipe 11 is disposed, which is supplied with the liquid by a branch passage 7a branched from the return passage 7, for gush-spraying the supplied liquid 4 so as to wash away sludge attached on the object, and recover the heat thereon. 5
Soon after that still another spraying pipe 12 washes away the remaining sludge on the object, and recovers the remaining heat therefrom for keeping the same cool and wet. The zinc phosphate conversion coating formed on the surface of the object 1 in such a way is chiefly made of fine phospho-
10 phyllite, which makes the object 1 highly corrosion resistant being covered with a zinc phosphate conversion coating of uniform thickness in all places irrespective of the shape thereof.

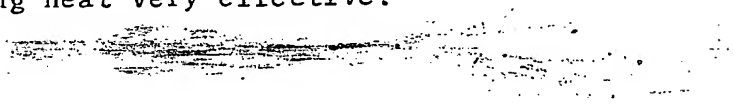
The dipping process in this invention will be
15 described more concretely with reference to the drawing. In Fig. 2 which illustrates how the object 26 is dipped into the liquid, numeral 21 designates a treating vessel for containing the phosphate treating liquid. The phosphate liquid as the chemical conversion liquid contained in the
20 treating vessel 21, while being controlled at a predetermined level of phosphate concentration, is recycled at a flowing speed of V_d in a direction shown with an arrow D. To an overflow tank 22 for the treating liquid disposed on the right side in Fig. 2, i.e., the side from which the object
25 26 is dipped, overflowed liquid from the treating vessel 21 is flowed into. This liquid is recycled by way of a conduit 27, pumps P_1 , P_2 , and P_3 , etc., to the treating vessel 21 for the purpose of reutilization thereof and controlling the flowing speed of the treating liquid in the treating vessel
30 21. Numeral 24 designates the surface of the treating liquid. The object-to-be-treated 26, being a car body here which is conveyed from right to left by a hanging conveyer 23 in a direction shown with an arrow C, is begun to be dipped into the treating liquid at a point A in Fig. 2. At a point B
35 it is horizontally positioned in a completely dipped state while being continuously shifted leftwardly in the liquid.

In the course of shifting from the point A to the

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point B the object 26 receives to the lower portion thereof, where the shape is so complicated as to often form portions enveloping air bubbles preventing the contact of the liquid, gushing of the liquid from a plurality of gushing nozzles
5 25 for eliminating the disadvantage.

As can be understood from the above description this invention is summarized to the following three features from the standpoint of the effect. The gush-spraying immediate before and/or immediate after the dipping of the object 1 in
10 the liquid 4 satisfactorily prevents the trace of uneven contact of the object with the liquid surface and other undesirable by-effects in the surface treatment. The counter-flow of the liquid 4 against the travelling direction of the object 1 caused by the device of this invention is highly
15 effective in letting the liquid 4 reach every part of the object 1 irrespective of its shape so as to make the surface treatment quite uniform. The gush-spraying of the liquid 4 soon after the object 1 has been lifted up out of the liquid bath 3 makes the washing away of the remaining sludge and the
20 recovering of the remaining heat very effective.



CLAIMS:

1. A method of surface treatment wherein an object-to-be-treated is continuously applied a predetermined surface treatment while it is immersed under continuous movement in a treating liquid, said method characterized by including steps of gush-spraying said treating liquid on said object-to-be-treated immediate before and/or immediate after immersing thereof into the treating liquid; imparting a counter flow to the treating liquid against the moving direction of the object-to-be-treated; and gush-spraying the treating liquid on the object-to-be-treated immediate after lifting up of the same out of the treating liquid.
2. The method as claimed in claim 1, characterized in that said surface treatment is a phosphating for forming a phosphate conversion coating on the surface of said object-to-be-treated.
3. The method as claimed in claim 2, characterized in that said treating liquid is gush-sprayed on said object-to-be-treated within 30 seconds before the same is immersed into the treating liquid.
4. The method as claimed in claim 2, characterized in that said treating liquid is gush-sprayed on said object-to-be-treated within 60 seconds after the same has been immersed into the treating liquid.
5. The method as claimed in claim 2, characterized in that said object-to-be-treated is completely covered all over the surface thereof with phosphate conversion coating while the same is shifted, taking 60-300 seconds, is said treating liquid in immersed state therein.
6. The method as claimed in any one of claims 2-5, characterized in that said phosphating employs zinc phosphate solution.

7. An apparatus for surface treatment characterized by including:

- a treating vessel (3) filled with a treating liquid;
- a first gush-spraying means (5a, 5b) of the treating liquid disposed singly or in a pair at a position of the treating vessel (3) where the initial stage begins over the surface of the treating liquid and/or immersed in the treating liquid;

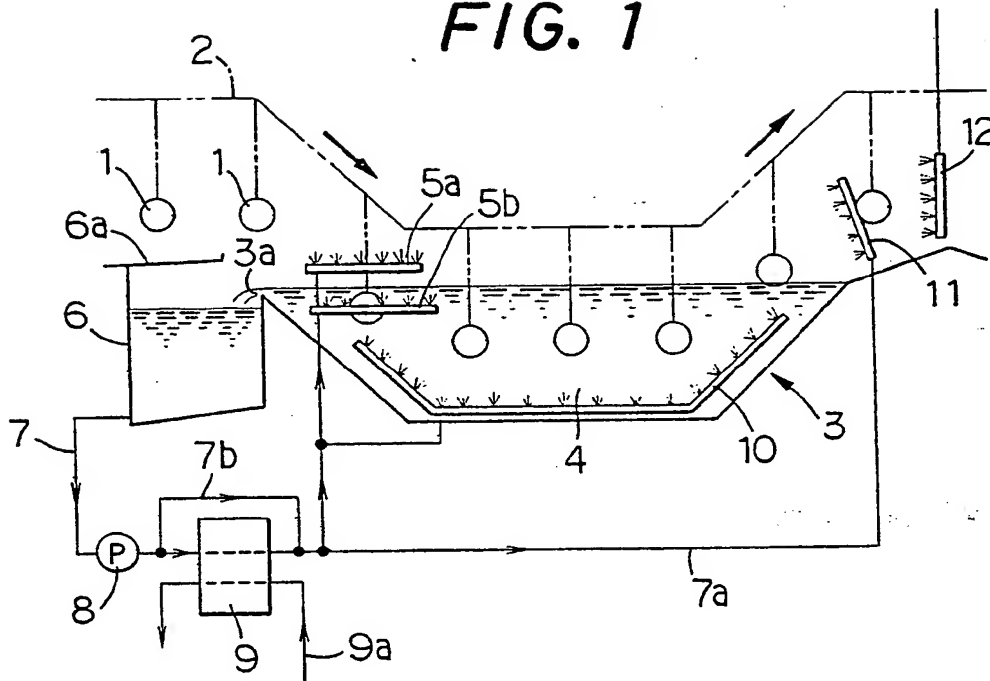
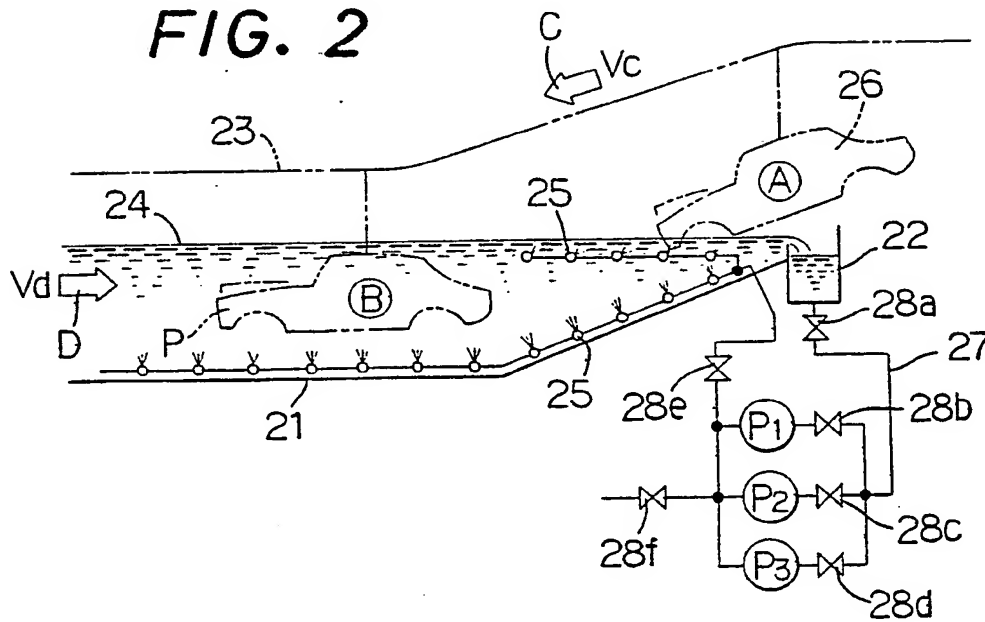
- an overflow outlet (3a) disposed on the initial stage side end of the treating vessel (3);

- an overflow tank (6) for reservoiring the overflowed treating liquid from the overflow outlet (3a);

- a return passage (7) for returning the treating liquid from the overflow tank (6) to the treating vessel (3); and

- a second gush-spraying means (11) of the treating liquid disposed at a position of the treating vessel (3) where the surface treatment is finished.

8. The apparatus as claimed in claim 7, characterized in that a third gush-spraying means (10) of the treating liquid is disposed on the bottom of the treating vessel (3) to immerse in the treating liquid, and the overflowed treating liquid is supplied to the third gush-spraying means (10) by way of the return passage (7).

FIG. 1**FIG. 2**

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EUROPEAN SEARCH REPORT

Application number

EP 81 10 3402

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	FR - A - 2 443 513 (NIPPON PAINT) * claims 1-5; 8; 11-15; page 8, lines 8-21; figure 1; page 2, lines 1-8 *	1-4, 6-8	C 23 F 7/00 B 05 C 3/10
X	US - A - 4 196 023 (CARRIER DRYSYS) * claim 1 *	5	
E/X	EP - A - 0 040 369 (TOYOTA JIDOSHA) * claims 1-4, 10; figure 2; figure 4; page 4; line 11 to page 5, line 37 *	1-4, 6-8	TECHNICAL FIELDS SEARCHED (Int. Cl. 3) C 23 F 7/00 C 23 F 7/08 B 05 C 3/10 B 05 C 21/00 B 05 D 7/14
			CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons
<p>The present search report has been drawn up for all claims</p>			<p>&: member of the same patent family, corresponding document</p>
Place of search The Hague		Date of completion of the search 06-01-1982	Examiner TORFS

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